



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



FAN6103

Power Supply Supervisor Plus PWM

Features

- PC Half-Bridge Power Supply Supervisor Plus PWM
- High Integration, Few External Components
- Over-Voltage Protection for 3.3V, 5V, and 12V
- Under-Voltage Protection for 3.3V, 5V, and 12V
- Under-Voltage protection for -12V and/or -5V
- Over-Power and Short-Circuit Protection
- Power-Down Warning Circuitry
- Power-Good Circuitry
- Delay Time for PSON and PG Signal
- Remote ON/OFF Function
- On-Chip Oscillator and Error Amplifier
- Latching PWM for Cycle-By-Cycle Switching
- Push-Pull PWM Operation and Totem-Pole Outputs
- Soft-Start and Maximum 93% Duty Cycle

Description

FAN6103 controller is designed for switching mode power supply for desktop PCs. It provides all the functions necessary to monitor and control the output of the power supply. Remote ON/OFF control, power good circuitry, and protection features against over-voltage and over-power are implemented. It directly senses all the output rails for OVP without the need of external dividers. An innovated AC-signal sampling circuitry provides a sufficient power-down warning signal for PG.


A built-in timer generates accuracy timing for control circuit, including the PS-off delay. The cycle-by-cycle PWM switching prevents the power transformer from saturation and ensures the fastest response for the short-circuit protection, which greatly reduces the stress for power transistors.

Utilizing minimum external components, the FAN6103 includes all of the functions for push-pull and/or half-bridge topology, decreasing the production cost and PCB space, while increasing the mean time between failures for power supply

Applications

- Desktop PC Power Supply

Ordering Information

Part Number	Operating Temperature Range	 Eco Status	Package	Packing Method
FAN6103NZ	-40°C to +105°C	RoHS	16-Pin Dual Inline Package (DIP)	Tube

 For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Application Diagram

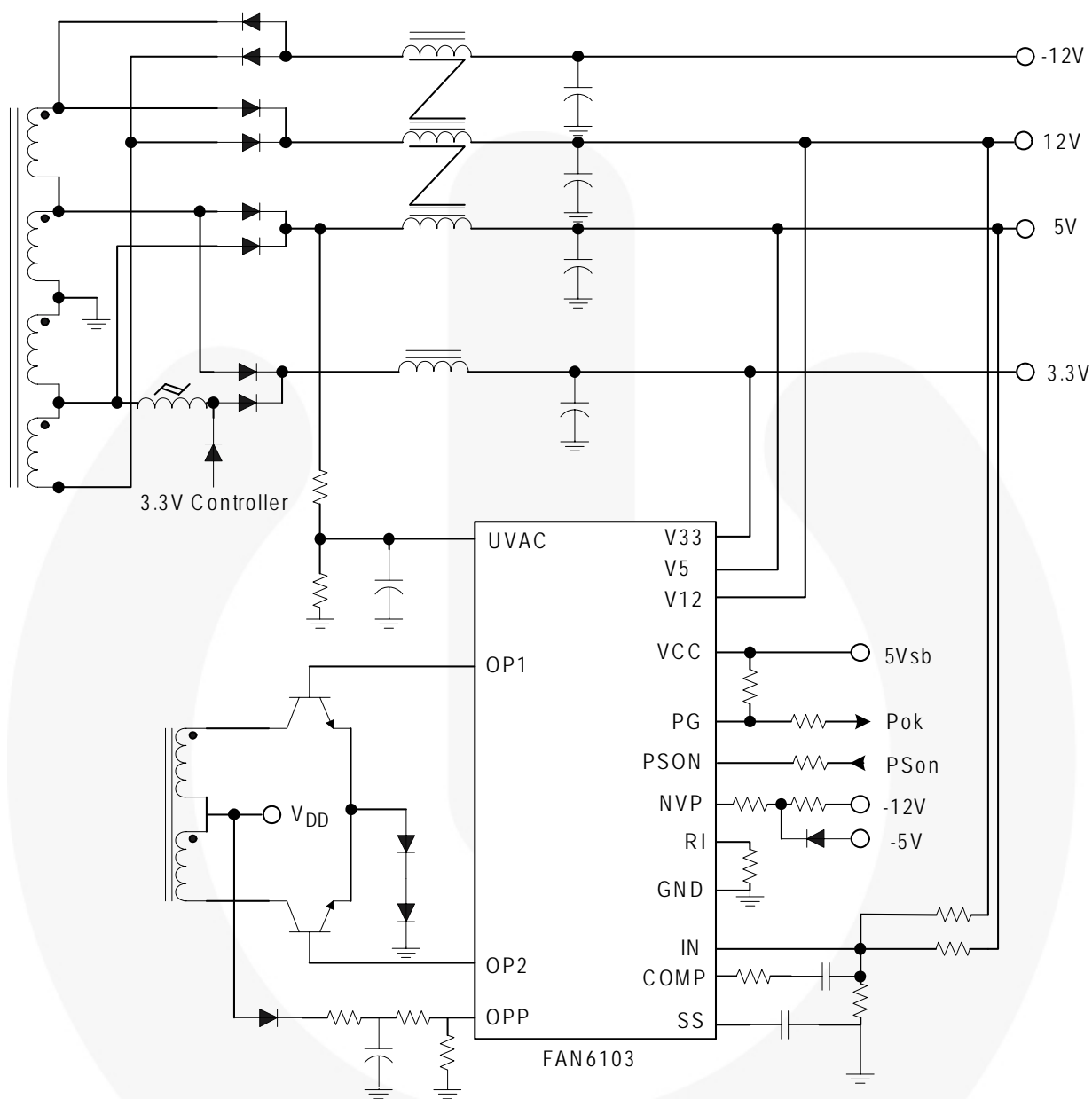


Figure 1. Typical Application

Block Diagram

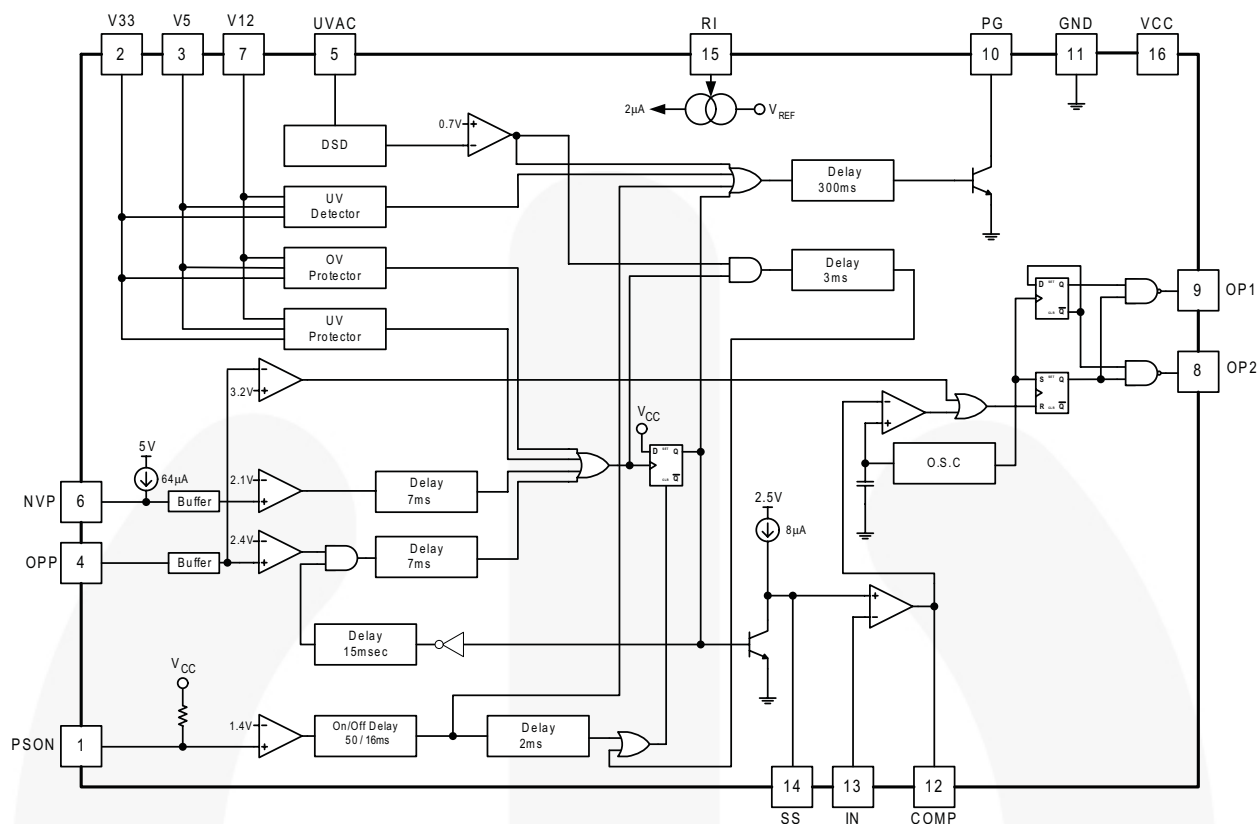


Figure 2. Function Block Diagram

Marking Information



- F** – Fairchild Logo
- Z** – Plant Code
- X** – 1-Digit Year Code
- Y** – 1-Digit Week Code
- TT** – 2 -Digit Die Run Code
- T** – Package Type (N:DIP)
- P** – Z: Pb Free
- M** – Manufacture Flow Code

Figure 3. Top Mark

Pin Configuration

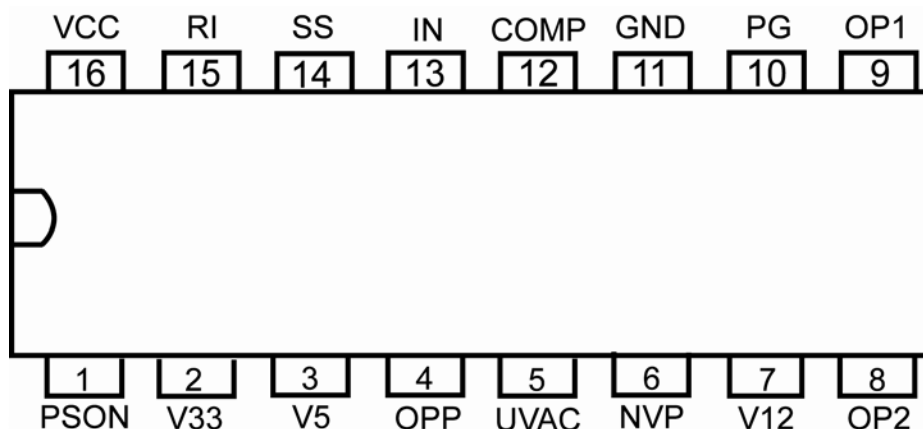


Figure 4. Pin Configuration

Pin Definitions

Pin #	Name	Description
1	PSON	Remote on/off logic input. Turn on/off the PWM output after the 16ms / 50ms delay. PSON = 0 means that the main SMPS is operational. PSON = 1 means that the main SMPS is off and the latch is reset.
2	V33	3.3V over-voltage/under-voltage control sense input.
3	V5	5V over-voltage/under-voltage control sense input.
4	OPP	Over-power sense input. This pin is connected to driver transformer or the output of current transformer. When not in use, this pin should be grounded.
5	UVAC	AC-fail detection. Detect main AC voltage under-voltage or failure.
6	NVP	The protection input for negative output , such as –12V and/or –5V; trip voltage = 2.1V.
7	V12	12V over-voltage/under-voltage control sense input.
8	OP2	The totem-pole output drivers of push-pull PWM. The output are enabled (LOW) only when the NAND gate inputs are HIGH; the maximum duty cycle on output OP2 is 46%.
9	OP1	The totem-pole output drivers of push-pull PWM. The output are enabled (LOW) only when the NAND gate inputs are HIGH the maximum duty cycle on output OP1 is 46%.
10	PG	Power-good logic output, 0 or 1 (open-collector). PG = 1 means that the power is ready for operation. The PG delay is 300ms.
11	GND	Ground.
12	COMP	Error amplifier output and the input of the PWM comparator.
13	IN	The negative input of error amplifier. The positive input of error amplifier is a 2.5V reference voltage.
14	SS	The soft-start , it is settable through an external capacitor. The current source output at this pin is 8μA and the voltage is clamped at 2.5V.
15	RI	Reference Resistor. Connected to external resistor for the reference setting.
16	VCC	Supply voltage; 4.5V ~ 5.5V, connected to 5V standby.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V _{CC}	DC Supply Voltage			16	V
V _H	Supply Voltage on PSON, V33, V5, V12, OP1, OP2 Pins		-0.3	16.0	V
V _L	Supply Voltage on OPP, UVAC, RI, SS, NVP, IN, COMP, PG Pins		-0.3	7.0	V
I _{OUT}	Output Current at PG			30	mA
P _D	Power Dissipation T _A < 50°C			1500	mW
Θ _{JA}	Thermal Resistance (Junction-to-Air)			82.5	°C/W
T _J	Operating Junction Temperature		-40	+125	°C
T _{STG}	Storage Temperature Range		-55	+150	°C
T _L	Lead Temperature (Soldering)			+260	°C
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114		3000	V
		Charged Device Model, JESD22-C101		1250	

Notes:

1. All voltage values, except differential voltage, are given with respect to GND pin.
2. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
T _A	Operating Ambient Temperature	-40	+105	°C

Electrical Characteristics

$V_{CC} = 5V$, $T_A = 25^\circ C$, and $R_I = 75k\Omega$ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{CC} Section						
V_{CC}	DC Supply Voltage		4.5		5.5	V
I_{CC1}	Total Supply Current	PSON = LOW, OP1/OP2 = 1000pF			10	mA
I_{CC2}	Total Supply Current	PSON = HIGH, OP1/OP2 = 1000pF		5	10	mA
Protection Section						
V_{OVP}	Over-Voltage Protection	3.3V	3.9	4.1	4.3	V
		5.0V	5.8	6.1	6.5	V
		12.0V	13.9	14.5	14.9	V
V_{UVP}	Under-Voltage Protection	3.3V	2.0	2.6	2.8	V
		5.0V	3.0	3.6	3.9	V
		12.0V	6.0	7.2	8.0	V
V_{UVS}	Under-Voltage Sense for PG Low	3.3V	2.5	2.8	3.0	V
		5.0V	4.0	4.3	4.5	V
		12.0V	9.4	10.1	10.4	V
V_{OPP}	Over-Power Protection (with T_{OPP} Delay Time) ⁽³⁾	$V_{UVAC} = 1.5V$	2.25	2.32	2.39	V
V_{OPPH}	Over-Power Protection (without Delay Time)		3.0	3.2	3.4	V
V_X	Disable Under-Voltage / Over- Power Protection Threshold		0.2	0.3	0.4	V
V_{NVP}	Negative Voltage Protection Voltage Level		2.0	2.1	2.2	V
I_{NVP}	Negative Voltage Protection Source Current		63	67	71	μA
T_{OVP}	Timing for Over-Voltage Protection		0.37	0.70	1.35	ms
T_{UVP}	Timing for Under-Voltage Protection		0.80	2.40	3.75	ms
T_{UVS}	Timing for Under-Voltage Sense for PG Low		0.37	1.20	1.88	ms
T_{OPP}	Timing for Over-Power Protection		5	7	9	ms
T_{NVP}	Timing for Negative Voltage Protection		3.3	7.0	10.2	ms
PWM Output Section						
V_{OL}	Output Voltage Low				0.8	V
V_{OH}	Output Voltage High		4			V
R_O	Output Impedance of V_{OH}		1.5		3.3	k Ω

Note:

3. $V_{OPPS} = (2/3) \cdot V_{OPP} + (1/3) \cdot V_{UVAC}$.

Continued on following page...

Electrical Characteristics (Continued)V_{CC} = 5V, T_A = 25°C, and R_I = 75kΩ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Power-Good Section						
t _{PG}	Timing for PG Delay	R _I = 75kΩ	200	300	400	ms
V _{UVAC}	UVAC Voltage Sense for PG		0.68	0.70	0.72	V
t _R	PG Good Output Rising Time	C _L = 100pF, Pull 2.25V to 5.00V		1	3	μs
t _F	PG Good Falling Time	C _L = 100pF, Pull to 5.00V to 2.25V		300	500	ns
V _{OL2}	PG Output Saturation Level	I _{PG} = 10mA			0.5	V
I _{ON2}	PG Leakage Current Collector	V _{PG} = 5V			1	μA
Remote ON/OFF Section						
V _{IH}	High-Level Input Voltage		2			V
V _{IL}	Low-Level Input Voltage				0.8	V
V _{HYSTERESIS}	PSON Input Hysteresis Voltage		0.3			V
I _{PSON}	Remote Input Driving Current				0.5	mA
t _{PSON(ON)}	Timing PSON to ON	R _I = 75kΩ	38	50	62	ms
t _{PSON(OFF)}	Timing PSON to OFF	R _I = 75kΩ	8	16	24	ms
t _{PSOFF}	Timing PG LOW to Power OFF	R _I = 75kΩ	1.5	2.0	6.3	ms
Error Amplifier Section						
V _{REF}	Reference Voltage	T _A = 25°C	2.46	2.50	2.54	V
I _{IB}	Input Bias Current				0.1	μA
A _{VOL}	Open-Loop Voltage Gain		50	60		dB
BW	Unity Gain Bandwidth		0.3	1.0		MHz
PSRR	Power Supply Rejection Ratio		50			dB
Oscillator Section						
f _{OSC}	PWM Frequency	R _I = 75kΩ	62	65	68	kHz
DC _{MAX}	Max Duty Cycle		85		93	%
Soft-Start Section						
I _{SS}	Charge Current		7	8	9	μA

Typical Performance Characteristics

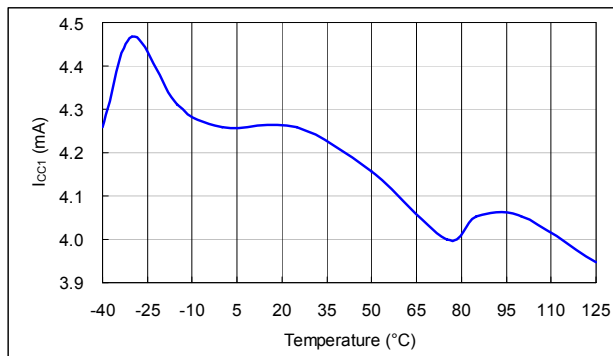


Figure 5. Operating Supply Current vs. Temperature

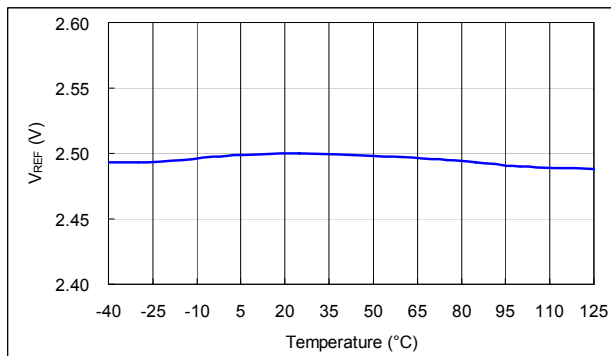


Figure 6. Reference Voltage vs. Temperature

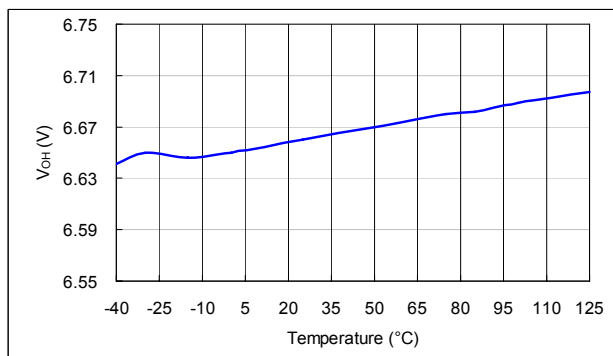


Figure 7. PWM Output Voltage vs. Temperature

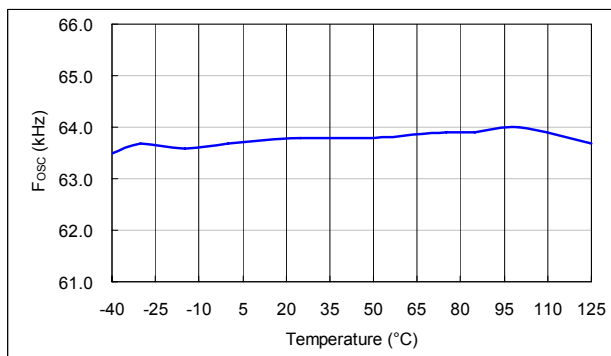


Figure 8. Frequency vs. Temperature

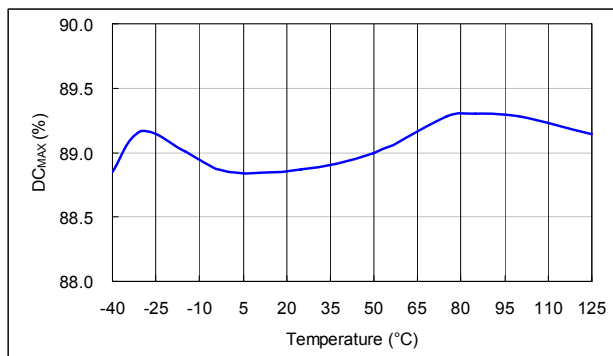


Figure 9. Maximum Duty Cycle vs. Temperature

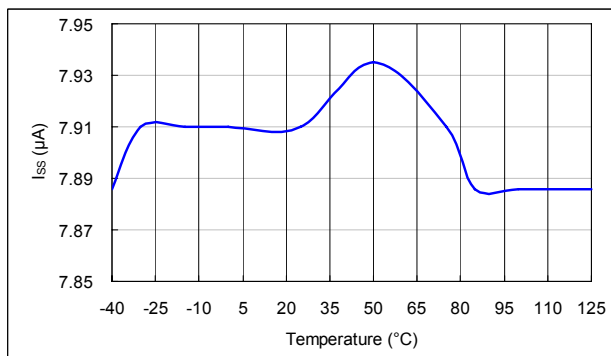


Figure 10. Charge Current vs. Temperature

Typical Performance Characteristics (Continued)

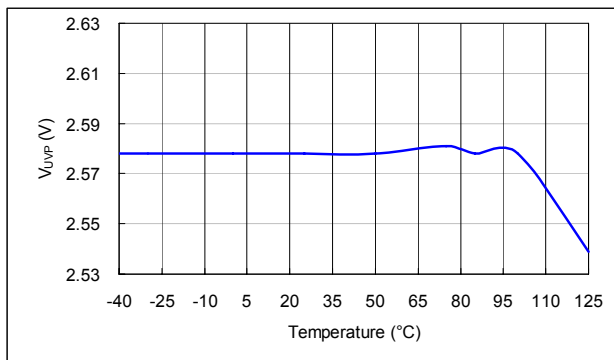


Figure 11. 3.3V V_{UMP} vs. Temperature

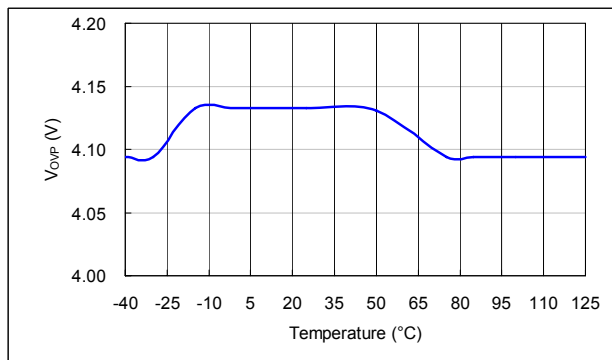


Figure 12. 3.3V V_{OVP} vs. Temperature

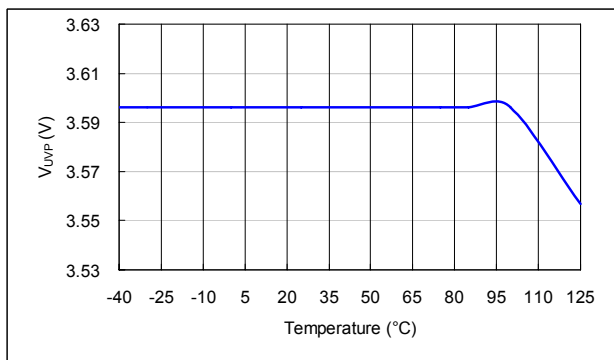


Figure 13. 5V V_{UMP} vs. Temperature

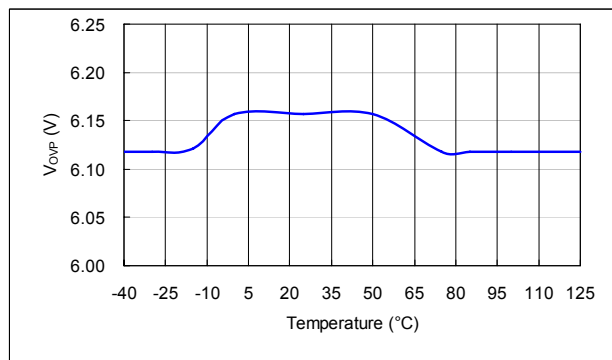


Figure 14. 5V V_{OVP} vs. Temperature

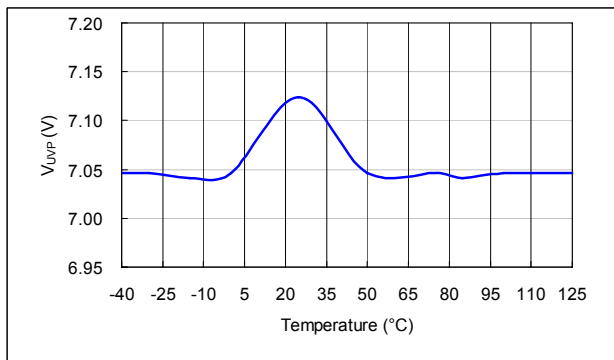


Figure 15. 12V V_{UMP} vs. Temperature

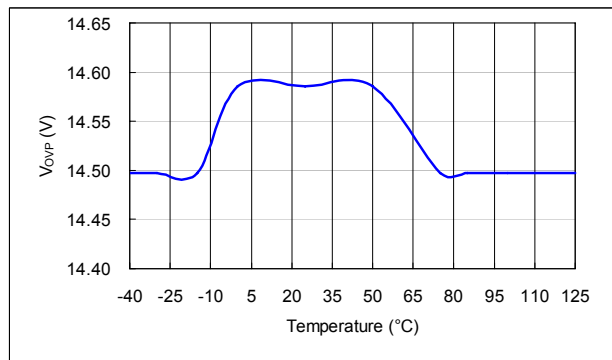


Figure 16. 12V V_{OVP} vs. Temperature

Functional Description

FAN6103 is suitable for half-bridge, push-pull topology and incorporates with a three-channel supervisor. The PWM section comprises a built-in 65KHz oscillator and high-immunity circuits, which protect the system from noise interference and provide more noise margins. FAN6103 has OVP and UVP for 12V, 5V, and 3.3V. NVP is used for negative voltage protection, such as -12V and/or -5V. The UVAC is applied to detect AC line condition.

Over-Power Protection (OPP)

FAN6103 provides over-power protection to detect over-power or short-circuit conditions. When it detects the voltage level over 2.4V, the supervisor triggers PG to LOW and pulls the SS pin LOW to switch off the power.

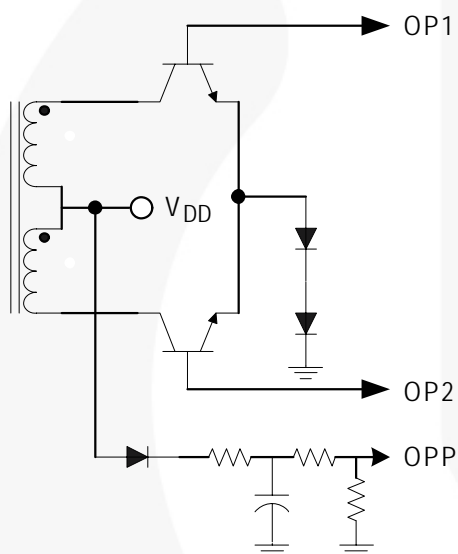


Figure 17. OPP Protection Circuit

Negative-Voltage Protection (NVP)

The NVP provides an under-voltage protection for negative voltage output. An under-voltage represents the phenomenal of the overload condition in negative voltage output. For example, the -12V output may drop to -10V during the overload situation. A resistor determining the threshold of the protection is connected from pin NVP to the negative voltage output. Via this resistor, NVP output a 64μA constant current to the negative voltage output. When the NVP voltage is over 2.1V for longer than 7ms, FAN6103 locks the power output off:

$$V_{NVP} = 64\mu A \times (R_1 + R_2) + (-12V) \quad (1)$$

The power outputs are locked off when $V_{NVP} > 2.1V$.

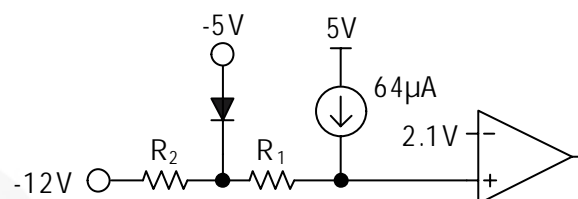


Figure 18. NVP Protection Circuit

AC-Fail Detection

Through a resistor divider, UVAC is connected to the secondary power transformer for detecting the AC line condition. Once the voltage of UVAC is lower than 0.7V for a period of time, such as 200μs, the PG signal is pulled LOW to indicate an AC line power-down condition. The voltage amplitude of the PWM switching signal in the secondary power transformer is proportional to the AC line voltage. Adjust the ratio of resistor divider to determine the threshold of power-down warning. A small capacitor is connected from UVAC to ground for filtering the switching noise.

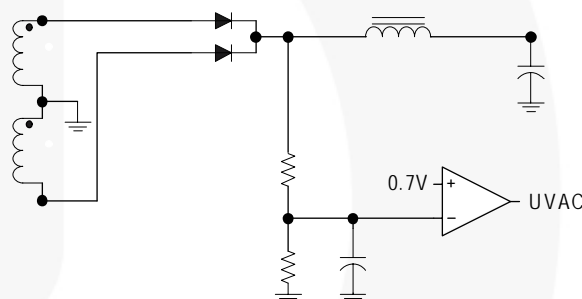


Figure 19. AC Detection Circuit

Timing Chart

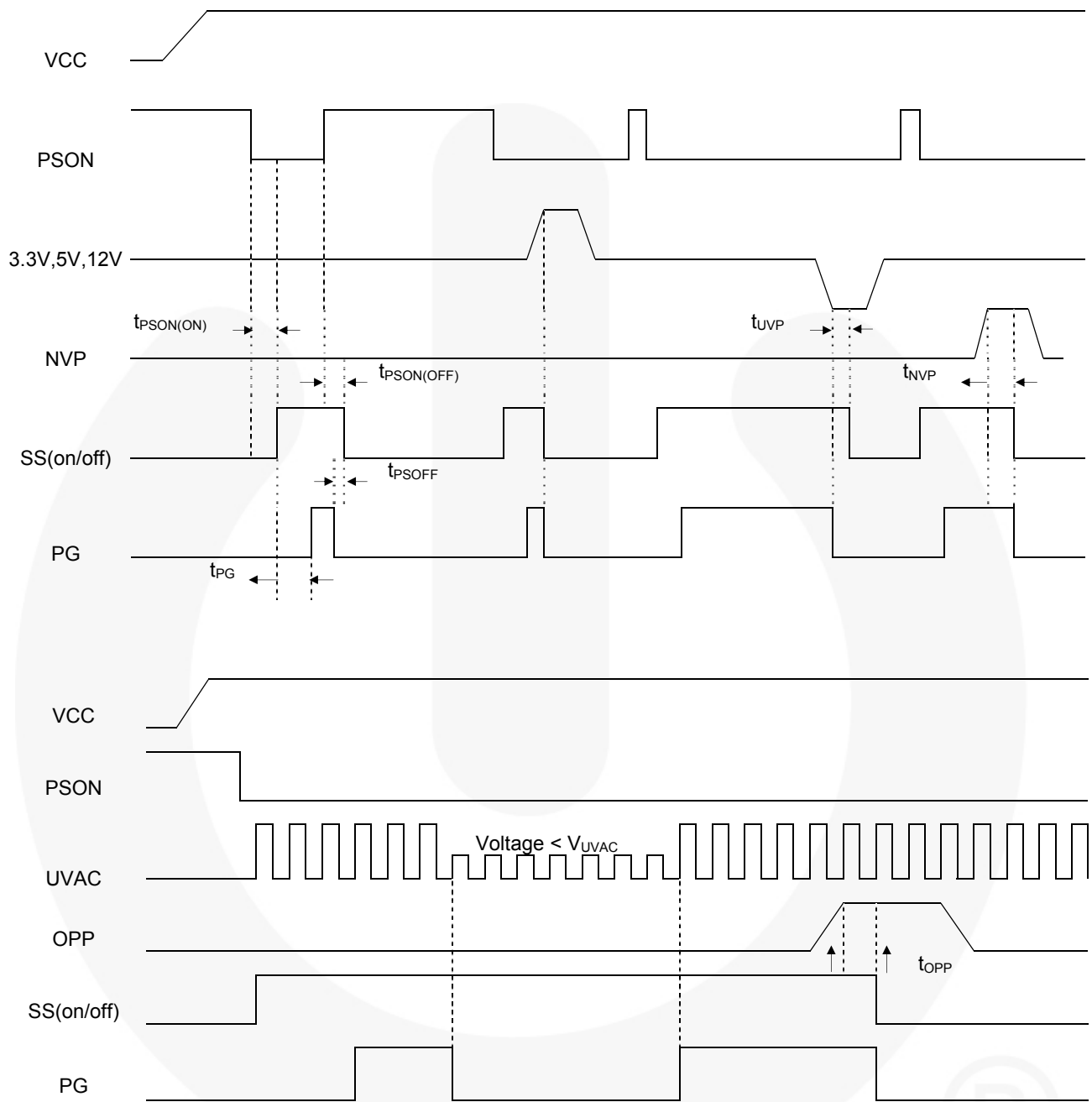


Figure 20. Timing Diagram

**TRADEMARKS**

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
Auto-SPM™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
EcoSPARK®
EfficientMax™
EZSWITCH™**
EZ™
DEUXPEED™
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™

FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource™
Green FPS™
Green FPS™ e-Series™
Gmax™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MillerDrive™
MotionMax™
Motion-SPM™
OPTOLOGIC®
OPTOPLANAR®
PDP SPM™

Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
Saving our world, 1mW/W/KW at a time™
SignalWise™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
Sync-Lock™

SYSTEM®*
GENERAL®
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TriFault Detect™
TRUECURRENT™*
µSerDes™
µSerDes®
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
XS™

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. 143

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative